Publication No. 44

British Research Association
for the
Woollen and Worsted Industries

A Comparison
of the Products of
Different Types of Carding Engines
Working 64's Botany Wool

By
W. J. HALL and (the late) TOLSON SPENCER.

NOTE.—It is with deep regret that we record the death of Tolson Spencer, one of the authors of this paper.

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March, 1925.

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A Comparison of the Products of Different Types of Carding Engines, working 64's Botany Wool.

Spinning to 32.8 skeins or 8,400 yds. per lb.

INTRODUCTION.

The experiments here described were carried out in precisely the same manner as those on the 46's crossbred blend reported in Publication No. 36. As in that case, it is difficult to draw definite conclusions from the work in a number of different mills owing to the simultaneous operation of a number of factors. Of the latter, by far the most important is the personal one. Two different carding engineers will not necessarily achieve the same result with a given carding engine and further, will probably employ different methods when seeking the same end. The experiments on the crossbred blend were interpreted as a convincing proof of the necessity of having at Torridon a woollen plant. Under conditions entirely free from the necessity of continuous running to maintain output, it will be possible to make alterations and adjustments so that one factor only may be varied at a time and ultimately the influence of the various factors may be determined.

Since the publication of the results of the experiments on the crossbred blend, much progress has been made with the scheme for the woollen plant. The building is now complete and the delivery of the machinery is awaited.

Meanwhile, the tests on the crossbred and on the present flannel blend have proved of considerable value, though caution has to be observed in drawing conclusions. The figures of comparative speeds, yield, output, etc., give us much information with which the working of our new set can be compared. The methods of testing which have been developed will also prove of service, and in fact on this account alone invaluable experience has been gained. This side of the work will form the subject of one or two forthcoming papers, and would have had to be carried out in any case before we could measure accurately the results of our later experiments here. One may mention, as an example, the ordinary variation in strength, count, etc., of commercial yarns. Further, there has been little or no publication elsewhere of such information.

It is therefore suggested that though we cannot at present make definite recommendations, yet members may glean a good deal by way

of suggestion, in the study of the efficiency of their own plants. (We have, in fact, proof that the crossbred paper has already stimulated experiment, and even alteration of plant).

Messrs. Kelsall & Kemp kindly placed at the disposal of the Association 6,000 lbs. of a flannel blend* of about 64's quality. From their own woollen plant they chose four carding engines on which to work six lots of 500 lbs. each. Six lots of the same weight were also sent to other firms for carding and spinning at the minimum commission rate.

As in the previous experiments observations were made during the carding and spinning of the different lots, and samples of the yarns were collected for testing under controlled conditions of temperature and relative humidity at Torridon. Small patterns were woven from each lot, warp and weft the same, and these were examined both in the grease and after scouring and milling. The yarns were tested for strength (single threads and hanks), count, and twist, and the cloths for strength and weight. In the testing the methods used were the same as in Publication No. 36, and the reduction of the results was carried out in a similar way. The detailed results are therefore relegated to an Appendix,† the summarised results only being given in the body of the paper.

The Association desires to express its thanks to the firms who have assisted in this work.

CONCLUSIONS.

As pointed out above these experiments have been carried out under conditions in which it was impossible to avoid the simultaneous operation of a number of separate factors, all of which influence the results. In particular it is well known that the skill, and the methods of working and setting of individual carding engineers vary considerably and may outweigh other factors. It has been assumed, for the purpose of studying the results, that the machines were in average adjustment, although it was obvious that this was not always the case, and some of the sets were not doing as well as they should. The results which appear on later pages would, however, appear to point generally to the following conclusions :—

(1) The slight difference in quality between the best of the tape condenser yarns and the single stripper yarns might be interpreted as in favour of the latter. The tape condenser, however, has the advantage of larger output.

(2) For this blend condensing to 17½ skeins gives the best results for those yarns which are spun to 33 skeins. Finer cardings give weaker yarns and cloths.

* The particulars of the preparation of the blend are shown in Appendix I.

† Appendix II.

(3) Although there are undoubtedly special cases in which double spinning is necessary for other reasons, such as the production of very fine counts, the necessity of the double process for moderate counts should be carefully questioned as it does not seem to justify the extra cost.

(4) A 66% increase (from 9 to 15 r.p.m. or from 18.9 to 31.4 ft. per min.) in the surface drum speed on a particular tape condenser was accompanied by an appreciable reduction in the strengths of the yarns and cloths. Another tape condenser running at 15 r.p.m. (35.4 ft. per min.) gave a first rate yarn.

(5) The outputs of the tape condenser machines range from 9.4 to 20.0 lbs. per hour (17½ skeins—60 in. machines). Since the set giving 20 lbs. per hour is fourth in order of merit it would appear that in experienced hands such output is quite feasible.

(6) The woollen spinning frame gave results not greatly different from the mule. The slubbings were of the same weight for both mule and frame.

BRIEF DESCRIPTIONS OF MACHINES

WITH OUTPUTS AND YIELDS.

In Table A below, the composition of the different machines is shown in the briefest outline.* The sizes and speeds of the surface drums and the numbers of threads are also given since these must be considered along with the outputs of the carding engines. The weights of yarn and soft waste yielded by the several 500 lb. batches have been expressed as percentages of the oiled weight. In the reading of these figures the size of the lots must be borne in mind. Yield figures from small blends are not usually representative of large blends and are subject to considerable error.

No comment upon this table is required except with respect to Lots J, K, L and M. In the case of Lot J the wool was divided into two lots which were carded at different speeds. The cardings corresponding to each speed were again divided, part being spun in the mule and part in the woollen spinning frame. Lots K and L were each divided into two parts, the first part being carded and spun in the usual manner. The second part was condensed to a heavier count and was drawn to an intermediate count in one mule with left hand twist and spun to the nominal count with right hand twist in a second mule. Lot M was also divided into two parts, one being condensed to 20 skeins and the other to 17¾ skeins, the spinning being direct in each case.

* The detailed particulars are given in Appendix III.

TABLE A. BRIEF DESCRIPTIONS OF MACHINES WITH OUTPUTS AND YIELDS.

Lot	Machine	Surface Drums		No. of Threads	YIELD—% of oiled weight			Output of Cardings in lbs. per hr.	Fig. of Merit for strength from Table B	Theoretical Relative Carding Power of Set*
		Diam.	r.p.m.		Yarn	Soft Waste	Total yield			
A	Breast and Swift, Balling Machine, Creel, Breast and Swift, Scotch Feed, Tummer and two Swifts, Endless Tape Condenser	9″	13	120 on 60″	78.0	4.4	82.4	17.3 (17½ skeins)	116.5	52000
B	The same machine as Lot A	9″	15	120 on 60″	75.6	5.3	80.9	20.0 (17½ skeins)	107.1	52000
C	Two Swifts, Balling Machine and Creel, Swift, Scotch Feed, two Swifts, Single Ring Doffer	9″	19¾	60 on 60″	76.9	5.4	82.3	12.1 (17½ skeins)	115.7	44600
D	Breast and Swift, Balling Machine, Creel, Breast and Swift, Scotch Feed, two Swifts, Single Ring Doffer	9″	19¾	60 on 60″	77.7	2.9	80.6	12.8 (17½ skeins)	112.1	41996
E	The same machine as Lot D	9″	18	60 on 60″	77.6	6.1	83.7	11.65 (17½ skeins)	106.8	41996
F	Breast and two Swifts, Scotch Feed, Tummer and two Swifts, Series Tape Condenser	9″	14	90 on 60″	78.7	4.2	82.9	15.45 (17½ skeins)	99.3	29386
G.	(a) Three Swifts, Scotch Feed, Tummer and three Swifts, Endless Tape Condenser	8¾″	13¾	120 on 72″	79.0	6.5	85.5	16.5 (18 skeins)	(a) 88.5 (b) 84.9 Bottom Doffer	(a) 51728
	(b) Breast and four Swifts, Scotch Feed, Breast and two Swifts, Double Ring Doffers	8¾″	14	72 on 60″				9.2 (19½ skeins)	72.9 Top Doffer	(b) ——

* See p. 8.

TABLE A—(continued).

Lot	Machine	Surface Drums		No. of Threads	YIELD—% of oiled weight			Output of Cardings in lbs. per hr.	Fig. of Merit for strength from Table B	Theoretical Relative Carding Power of Set
		Diam.	r.p.m.		Yarn	Soft Waste	Total Yield			
H	Continental Type, Garnett Breast and one Swift, Scotch Feed, Fillet Breast, and one Swift, Series Tape Condenser	5″	21	140 on 72″	81.6	4.0	85.6	18.8 (20 skeins)	98.5	58040
J	Breast and four Swifts, Scotch Feed, two Swifts, Series Tape Condenser	8″	9 15	112 on 60″	79.0	3.4	82.4	9.4 (17½ skeins—9 r.p.m.) 15.7 (17½ skeins—15 r.p.m.)	104.8 (9 r.p.m.—mule) 100.6 (9 r.p.m.—frame) 97.5 (15 r.p.m.—mule) 99.3 (15 r.p.m.—frame)	56584
K	Breast and Swift, Balling Machine, Creel, Swift, Balling Machine, Creel, Swift, Single Ring Doffer	9″	20	60 on 60″	77.7	4.6	82.3	12.4 (18.4 skeins) 16.7 (13.7 skeins)	101.3 (Direct Spun) 101.2 (Drawn and Spun)	71412
L	Breast and Swift, Balling Machine, Creel, Tummer and Swift, Scotch Feed, two Swifts, Single Ring Doffer	9″	16	52 on 60″	80.9	5.5	86.4	8.45 (18¾ skeins) 10.2 (14.8 skeins)	106.0 (Direct Spun) 105.5 (Drawn and Spun)	50218
M	Breast and three Swifts, Scotch Feed, Tummer and two Swifts, Tape Condenser	8″	18	96 on 60″	82.0	2.2	84.2	14.2 (20 skeins) 16.0 (17¾ skeins)	95.7 (17¾ skeins) 85.8 (20 skeins)	31862

The theoretical carding powers of the sets have been calculated* from the width, diameters, speeds, and counts and crowns of the clothing. At present the significance of this is not fully known. For example no allowance is made for the fact that a part of the wool may be submitted a second or even a third time to the interaction between workers and swifts. The figures were calculated in order to see if there were any simple connection between carding power and the strength of yarn or cloth. A glance through the table shows no clearly marked relation.

THE TESTS ON THE YARNS AND CLOTHS.

The yarn was spun nominally to 8,400 yds. to the lb. (32.8 skeins). The samples were taken along the mule (or frame) during the doffing. In the majority of cases twelve cops or tubes were taken, in others nine cops, and in two cases where large cops were made the sample consisted of six cops. The tests were all carried out in the humidity room under constant conditions.

The methods of making the tests for strength on the yarns and cloths were described in Publication No. 36 and reference was made to the difficulty of the determination of the twist in the yarns. Since that work was done the question of twist testing has been investigated.† It is only necessary to state here that the actual twist in the yarn is less than that given by calculation from spindle revolutions and length of draw. In the table both the calculated twist (as given for the crossbred blend) and the actual twist are shown as a matter of interest. However, the effect of variations of twist in the different samples of yarn collected in these experiments is not so important as in the case of the crossbred blend, since the range of twist is much smaller.

For the measurement of the irregularity of the yarns the usual criterion adopted in statistical work has been employed. This is the coefficient of variation, or the standard deviation expressed as a percentage of the average. This figure is used in the tables, and for simplicity (though not quite exactly) may be taken to represent the percentage average variation. Thus consider a yarn that gave an average test of 100 lbs. and a coefficient of variation of 2%. The individual tests will be 1, 2, 3 or more pounds above or below the 100. If all these differences are averaged the result is 2 lbs. or 2%. Clearly the larger this coefficient the more irregular the yarn. A possible

* The method of calculation is as follows :

$$\text{Theoretical Carding Power} = W\,[\pi\, d_S \times n_S\, Co_S\, 2Cr_S - \pi d_W \times n_W\, Co_W\, 2Cr_W]$$

where π = 3.1416
W = width on wire in inches.
d_S = diameter of swift.
n_S = r.p.m. of swift.
Co_S = counts of clothing on swift.
Cr_S = crowns.
d_W, n_W, etc. the similar quantities for the worker.

The swift-doffer contacts are similarly calculated.

† It is hoped to publish this work in the near future. The discrepancy between actual twist and twist calculated from the spindle revolutions, and the length of the draw will be dealt with at length.

objection may be imagined. The weaver, for example, would prefer deviations from the average to be on the thick rather than on the thin side. The coefficient of variation, however, would be affected to the same extent by equal departures from the average in either direction.

The tables giving the actual results of the tests have been set out in Appendix II. In the following Table B the results are summarised.

TABLE B.

FIGURES OF MERIT FOR STRENGTH OF YARNS AND CLOTHS.

Order of Merit	Lot	Relative No. for Hank Test %	Rel. No. for Single Thread (Moscrop) Test %	Rel. No. for Cloth Test %	Fig. of Merit for Strength (Average % of 3 preceding columns)
1	A	122.0	113.2	114.2	116.5
2	C	118.9	115.7	112.4	115.7
3	D	113.1	112.3	110.8	112.1
4	B	106.8	104.0	110.5	107.1
5	E	107.3	105.7	107.4	106.8
6	L Direct Spun	112.7	104.3	100.9	106.0
7	L Drawn and Spun	108.1	104.7	103.7	105.5
8	J 9 r.p.m. Mule Spun	109.5	103.6	101.2	104.8
9	K Direct Spun	100.7	102.9	100.3	101.3
10	K Drawn and Spun	100.0	104.2	99.5	101.2
11	J 9 r.p.m. Frame Spun	100.9	98.0	103.0	100.6
12	F	96.0	97.6	104.3	99.3
13	J 15 r.p.m. Frame Spun	101.5	98.9	97.5	99.3
14	H	96.6	97.3	101.7	98.5
15	J 15 r.p.m. Mule Spun	96.2	96.6	97.8	97.5
16	M 17¾ Skein Cardings	91.8	97.0	98.3	95.7
17	G Tape Machine	94.7	95.1	75.8	88.5
18	M 20 Skein Cardings	77.9	85.2	94.3	85.8
19	G Bottom Doffer	77.6	86.3	90.7	84.9
20	G Top Doffer	67.5	77.6	73.5	72.9
	Average	100.0	100.0	100.0	100.0

The method by which the figures have been calculated is shown in the following example. In Table D, Appendix II, Column 4 gives the strengths (according to the hank test) of the 20 lots of yarn corrected to the standard

count of 32.8 skeins. The average of these figures is 44.58 lbs. The individual tests are then expressed as percentages of this figure. Thus the 54.4 lbs. for Lot A is replaced by the relative number 122.0 and the 30.1 lbs. for Lot G (top doffer) by 67.5. In other words the hank test shows Lot A to be 22% above the average, and Lot G (top doffer) 32.5% below. The results of the single thread and cloth tests have been treated in exactly the same way.

It will be seen at once that in general a high hank test is associated with a high single thread test and also a high cloth test. Consequently the relative numbers from the hank, single thread and cloth tests for each lot of yarn have been averaged and the results are taken as the figures of merit of strength.

TABLE C.

FIGURES OF MERIT FOR REGULARITY OF YARNS.

Order of Merit for Regularity	Lot	Coefficient of Variation of Count %	Highest Count % above average	Lowest Count % below average	Range % of average
1	J 15 r.p.m. Mule	2.19	4.6	5.4	10.0
2	J 9 r.p.m. Frame	2.24	5.1	4.4	9.5
3	C	3.03	5.3	5.3	10.6
4	B	3.17	7.2	5.7	12.9
5	E	3.50	7.9	5.1	13.0
6	L Direct Spun	3.59	7.1	7.5	14.6
7	K Drawn and Spun	3.66	6.0	9.2	15.2
8	J 9 r.p.m. Mule	3.72	7.5	4.4	11.9
9	H Continental	3.76	11.3	6.8	18.1
10	D	3.83	7.3	7.7	15.0
11	M 20 Skein Cardings	3.85	11.0	6.6	17.6
12	G Double Doffer	3.87	9.3	9.2	18.5
13	L Drawn and Spun	4.00	10.1	8.4	18.5
14	J 15 r.p.m. Frame	4.71	9.6	8.9	18.5
15	A	4.77	8.1	9.2	17.3
16	M 17¾ Skein Cardings	5.39	8.6	9.7	18.3
17	F	5.41	12.2	7.9	20.1
18	K Direct Spun	5.74	10.3	10.9	21.2
19	G Tape	6.21	15.2	11.7	26.9

Since a regular yarn of moderate average strength might give more satisfactory results in weaving or designing than a much less regular yarn of greater average strength, the regularity may be considered almost as important as the strength.

In Table C the lots are arranged in order of merit from the point of view of the regularity of the yarn. The most regular yarn will have the smallest coefficient of variation of count. The greatest and least values of the deviations have also been included in the table. It will be seen that the range, which is the difference between the highest count and the lowest count, increases as the coefficient of variation increases. Sometimes this might not be the case. A good level yarn having occasional bad places would have a large range, but not necessarily a large coefficient of variation. For instance in Table C, lot H is No. 9 in order of merit but has an extreme range of 18.1% which is worse than Nos. 10, 11 and 15. Quite possibly for some purposes, *e.g.*, black warp, white weft, this extreme variation column is the most important.

DISCUSSION OF THE RESULTS.

It will be seen on referring to Table A that a machine fitted with a tape condenser with the surface drums running at 13 r.p.m. has given the best product. Of the first five lots on the list, the first and fourth were worked on the same tape machine whilst the second, third and fifth were carded on two single stripper machines. There is so little between the first and second in the strengths of the yarns and cloths that the tape condenser and single stripper machines may be regarded as equally suitable for blends of this character (except from the point of view of output). Considering now the whole series we find that the lots worked on tape condenser machines appear in the table showing the order of merit in the positions 1, 4, 8, 11, 12, 13, 14, 15, 16, 17 and 18. The lots carded on single stripper machines occupy the positions 2, 3, 5, 6, 7, 9, 10. Thus on the whole it could be argued that the single stripper machines have given relatively the stronger yarns and cloths. Such a finding is subject to qualification on many accounts. For example some of the lots were worked on machines quite suitable for the blend and yet have given poor results, the engineers being accustomed to work of different character.

Lots A and B were worked on the same tape machine at surface drum speeds of 13 and 15 r.p.m. respectively. Lot A is clearly the stronger. Lots D and E were carded on the same single stripper machine, the surface drum speeds being $19\frac{3}{4}$ and 18 r.p.m. respectively. In this case the higher speed has given the better result. In those two instances the differences in speed were too small and the strengths of the yarns and cloths too nearly alike for any significance to be attached

to the results from the point of view of effect of speed. The four parts of Lot J, however, show clearly that greater strength has resulted from the lower speed (9 r.p.m.) At this speed the mule spun portion is better than that spun on the frame. At 15 r.p.m. the difference between the mule spun yarn and the frame spun yarn is small, but is in favour of the frame.

The Continental type of machine (Lot H) has given yarns and cloth rather weaker than the average. The action of the machine is drastic and may involve fibre breakage to a greater extent than machines of the English type. This may partly account for the test, but the fact that the slubbings were condensed to 20 skeins must not be forgotten ; for it appears that condensing to higher counts results in a loss of strength when the material is capable of sustaining spindle draft.

The evidence supporting this view, is provided by the two parts of Lot M which were condensed to $17\frac{3}{4}$ and 20 skeins respectively. The part condensed to $17\frac{3}{4}$ skeins is appreciably stronger than that condensed to 20 skeins.

The double doffer machine on which part of Lot G was carded would appear to be unsuitable for this blend. No information regarding the cards was available but they did not appear to be too coarse.

Lots K and L afford a comparison of direct spinning with drawing and spinning. In both cases it is seen that the strengths are practically the same. The portions drawn and spun have somewhat greater twist than those spun directly. In Appendix III. the times for direct spinning as against drawing and spinning are shown with the detailed particulars of Lots K and L. These indicate that by drawing and spinning yarns which could be spun directly, slightly inferior products are produced at a greater cost. This would be partly counteracted by the greater output of the carding engine.

The conclusions have already been set out on p. 4.

APPENDIX I.

PREPARATION OF THE BLEND.

Scouring. 8294 lbs. of a mixture of Queensland and Sydney (both Colonial scoured) 64's yielded 6949 lbs. (weighed as it left the drier) on scouring i.e. 83.8%.

The soap for scouring was made from 157½ lbs. of oil (78.9% free fatty acid) and 285 lbs. of soda ash.

The wool was stored for about a week after scouring in sheets of about 120 lbs. each.

Willowing. BREAKER. 3′ 6″ wide.

4 Breaker rollers 22″ diam. 1008 r.p.m.

These rollers have sieves above and below and this part of the machine is completely enclosed and is connected to a fan for dust extraction. The breaker and the willow have separate drives.

SPIVEY. OILING MACHINE.

Cylinder in oil trough 22 r.p.m.

Brush 438 ,,

Feed sheet to willow fed mechanically from breaker.

WILLOW 3′ 6″ wide.

Swift 48″ diam. 200 r.p.m.

3 Workers 6¼″ diam. 12 ,,

2 Strippers 5¼″ diam. 13 ,,

Wool weighed by hand on to feed sheet of breaker, 4 lbs. per 4 ft. of sheet.

OILING. 709 lbs. (324 quarts) of oil used for

5894 lbs. of wool, i.e. 12.0%

Loss in Willowing 2.02%

APPENDIX II. Tabulated Particulars of Tests.

Table D. Summary of Hank Tests.

66 yd. hanks wound on 36″ reel.
Goodbrand hank testing machine—power driven—rate of traverse of lower hook 12″ per min.
Each observed figure for strength is the average of 36 tests.

Lot.	Observed Average Strength. lbs.	Observed Average Count. Skeins.	Strength calculated to 32.8 skeins. lbs.	Calculated Twist. Turns per inch. From Spindle Revolutions and length of draw	Actual Twist (From Twist Tester) Turns per inch	Coefficient of Variation of strength of yarn %	Coefficient of Variation of Count of Yarn %
A	60.5	29.5	54.4	13.5	11.8	6.65	4.77
B	49.1	31.8	47.6	13.4	11.2	8.91	3.17
C	57.7	30.1	53.0	13.5	11.7	5.80	3.03
D	50.7	32.6	50.4	13.5	11.5	6.71	3.83
E	47.2	33.2	47.8	13.5	11.9	6.79	3.50
F	44.1	31.8	42.8	13.9	10.8	10.70	5.41
G (a) Tape Machine	45.0	30.8	42.2	14.1	11.8	14.70	6.21
G (b) Double Doffer Machine — Top Doffer	30.8	32.0	30.1	15.1	11.9	10.70	3.87
G (b) Double Doffer Machine — Bottom Doffer	36.8	30.8	34.6				
H	46.9	30.1	43.1	13.9	11.2	7.62	3.76
J 9 r.p.m. Mule	50.5	31.8	48.8	15.3	12.3	5.78	3.72
,, Frame	46.7	31.6	42.9	—*	11.9	3.86	2.24
15 ,, Mule	49.2	28.5	45.0	15.3	12.3	5.35	2.19
,, Frame	51.1	29.1	45.3	—*	13.0	4.64	4.71
K Direct Spun	47.1	31.2	44.9	13.6	11.2	7.61	5.74
Drawn and Spun	46.8	31.9	44.6	14.7	12.7	7.92	3.66
L Direct Spun	53.5	30.8	50.2	13.8	12.2	7.98	3.59
Drawn and Spun	50.1	31.6	48.2	15.6	13.7	6.35	4.00
M 17¾ Skein Cardings	42.7	31.5	41.0	14.9	12.4	8.30	5.39
20 Skein Cardings	39.4	29.0	34.7	14.5	12.2	8.30	3.85

* In this case the speed of the traveller would be required to find the twist. Also some allowance for the drafting due to the friction of the traveller would be necessary.

Table E.

Summary of Single Thread Tests on the Moscrop Machine.

The figures for the observed strength are the averages of about 950 tests.

Length of test piece $11\frac{1}{4}$". Machine worked by hand.

Lot	Observed Average Strength ozs.	Observed Count Skeins	Strength calculated to 32.8 Skeins. Ozs.	Coefficient of variation of Strength %
A	9.89	29.9	8.96	12.61
B	8.20	32.9	8.22	12.77
C	9.91	30.3	9.15	13.23
D	8.79	33.1	8.88	12.36
E	8.32	33.0	8.36	11.44
F	8.08	31.4	7.72	13.53
G (a) Tape Machine	8.24	29.9	7.52	14.36
G (b) Double Doffer Machine — Top Doffer	6.31	31.9	6.14	17.48
G (b) Double Doffer Machine — Bottom Doffer	7.02	31.9	6.83	12.50
H	8.18	30.8	7.70	12.96
J 9 r.p.m. Mule	8.58	31.4	8.20	12.59
J 9 r.p.m. Frame	8.05	31.6	7.75	13.37
J 15 r.p.m. Mule	8.70	28.8	7.64	13.99
J 15 r.p.m. Frame	8.85	29.0	7.82	12.60
K Direct Spun	8.74	30.5	8.14	13.78
K Drawn and Spun	8.57	31.5	8.24	13.08
L Direct Spun	8.73	31.0	8.25	12.72
L Drawn and Spun	8.79	30.9	8.28	12.41
M $17\frac{3}{4}$ Skein Cardings	8.56	29.4	7.67	12.50
M 20 Skein Cardings	7.72	28.7	6.74	15.60

Table F.

Shrinkage in Scouring and Milling.

Patterns in the grease were conditioned at 72°F. and 68% relative humidity and weighed. Marks 36″ apart in both warp and weft directions sewn in. All the patterns were sewn together and were scoured and milled with other pieces of similar cloth.

The scouring and milling operations consisted of :—

(1) Wetting out with soda ash solution.
(2) Milling with two pieces of flannel of the same make (to fill the machine) for three periods, 40, 45, and 20 minutes respectively. They were taken out and stretched twice during the milling.
(3) Scouring.
(4) Drying without tension over rails.
(5) Moistening and pressing to remove wrinkles.

As would be expected Lots H and F showed the largest number of seeds after scouring, etc., Lot G did not scour quite clean. The handle of the different patterns is so uniform that it would be impossible to identify them if the distinguishing marks were removed.

Before testing for strength the patterns were again conditioned, weighed and measured under precisely the same conditions as before. From the weights and the measurements the percentage loss in scouring and the percentage contractions in the warp and weft directions have been calculated.

Table F. Milling Power.

Lot	Loss in Milling and Scouring expressed as a percentage of the weight in the grease	Contraction in Warp expressed as a percentage of original length	Contraction in Weft expressed as a percentage of original width	Contraction in Area expressed as a percentage of original area
A	12.2	9.4	19.5	27.1
B	13.1	9.9	21.4	29.2
C	14.0	10.0	18.6	26.8
D	12.1	8.9	13.9	21.6
E	13.2	8.3	19.3	26.1
F	14.4	11.7	17.8	27.4
G (a) Tape Machine	14.2	10.3	18.3	23.9
G (b) Double Doffer	15.1 Top Doffer 14.8 Bottom Doffer	8.3 Top Doffer 7.9 Bottom Doffer	20.8 Top Doffer 16.7 Bottom Doffer	27.4 23.3
H	12.6	9.4	20.3	28.1
J 9 r.p.m. Mule ,, Frame	14.3 14.3	10.3 9.4	19.0 18.1	27.4 25.8
J 15 r.p.m. Mule 15 ,, Frame	13.2 14.7	7.8 8.1	17.0 17.5	23.4 24.2
K Direct Spun	12.1	12.5	22.2	31.9
K Drawn and Spun	13.9	11.2	18.5	27.7
L Direct Spun	13.1	9.2	18.3	25.8
L Drawn and Spun	12.9	10.0	22.8	30.5
M 17¾ Skein Cardings	12.9	9.6	20.1	27.9
M 20 Skein Cardings	13.9	7.9	16.4	21.5

Table G.

Summary of Strength Tests on the Cloth.

Goodbrand cloth tester with jams $6\frac{5}{8}''$ apart. Test pieces $9'' \times 6\frac{5}{8}''$. The strengths for the warp direction are averages of 14 tests and those for the weft are averages of 15 tests. Results reduced to the arbitrary standard of 7.00 gms.

Lot	WARP			WEFT			Average of Warp and Weft strength calculated to 7.00 grams lbs.
	Observed Average Strength lbs.	Observed Average Weight grams.	Strength calculated to 7.00 grams lbs.	Observed average Strength lbs.	Observed Average Weight grams	Strength calculated to 7.00 grams lbs.	
A	88.9	7.17	86.8	79.5	7.09	78.6	82.7
B	82.6	6.99	82.7	79.3	7.19	77.3	80.0
C	89.6	7.56	83.0	86.7	7.63	79.7	81.3
D	78.4	7.57	72.5	92.8	7.84	82.9	77.7
E	84.7	7.48	79.7	85.7	7.43	80.7	80.2
F	79.9	7.20	77.7	77.2	7.37	73.3	75.5
G (a) Tape Machine	52.1	6.88	53.0	54.8	6.77	56.7	54.8
G (b) Double Doffer	Top Doffer. 53.2	6.84	54.5	51.1	6.89	51.9	53.2
	Bottom Doffer. 60.9	6.86	62.1	63.3	6.41	69.1	65.6
H	79.9	7.28	76.8	73.0	7.26	70.4	73.6
J 9 r.p.m. Mule	74.9	7.11	73.7	74.7	7.18	72.8	73.2
J 9 r.p.m. Frame	76.2	7.30	73.0	79.2	7.28	76.1	74.6

TABLE G.—(continued).

Lot	WARP			WEFT			Average of Warp and Weft strength calculated to 7.00 grams lbs.
	Observed Average Strength lbs.	Observed Average Weight grams	Strength calculated to 7.00 grams lbs.	Observed Average Strength lbs.	Observed Average Weight grams	Strength calculated to 7.00 grams lbs.	
J 15 r.p.m. Mule	81.0	7.13	79.5	68.2	7.34	64.9	72.2
J 15 r.p.m. Frame	75.2	7.23	72.8	71.7	7.34	68.4	70.6
K Direct Spun	77.9	7.20	75.7	71.6	7.21	69.5	72.6
K Drawn and Spun	76.5	7.18	74.6	69.8	7.04	69.5	72.0
L Direct Spun	73.5	7.28	70.6	79.9	7.42	75.4	73.0
L Drawn and Spun	81.9	7.18	79.9	69.2	6.90	70.3	75.1
M 17¾ Skein Cardings	76.3	7.37	72.4	72.6	7.28	69.8	71.1
M 20 Skein Cardings	68.7	7.27	66.1	74.5	7.42	70.3	68.2

APPENDIX III.

DETAILED PARTICULARS OF CARDING ENGINES.

LOT A.

Platt Machine—Iron—Flat Bends.
60″ wide. Open Belt Drives.
Automatic Hopper Feed.

Scribbler.

3	Feed Rollers	2″	diam.	Garnett		—
	Lickerin	12″	,,	,,		52 r.p.m.
	Angle Stripper	4″	,,			390 ,,
	Breast	28″	,,	95/9	28g	52 ,,
2	Workers	8″	,,	95/9	28g	7¼ ,,
2	Strippers	4″	,,	80/8	29g	178 ,,
	Fancy (Covered)			60/6	28g	304 ,,
	Doffer	18″	,,	95/9	28g	9½ ,,
	Angle	7″	,,			126 ,,
	Swift	50″	,,	115/9		108 ,,
4	Workers	7¾″	,,	120/10	31g	3¼ ,,
4	Strippers	4″	,,	90/9		376 ,,
	Fancy (Covered)			60/6	30g	502 ,,
	Doffer	30″		120/10	31g	6¾ ,,
	Balling Machine.					
	Creel of 60 balls.					

Intermediate.

3	Feed Rollers	2″	diam.	Garnett		—
	Lickerin	9″	,,	,,		38 r.p.m.
	Angle	4″	,,			128 ,,
	Breast	30″	,,	100/9	30g	51 ,,
2	Workers	8″	,,	100/10	30g	3¾ ,,
2	Strippers	4″	,,			84 ,,
	Angle	6″	,,			520 ,,
	Swift	50″	,,	120/10	33g	112 ,,
4	Workers	7¾″	,,	120/10	33g	3¾ ,,
4	Strippers	4″	,,	90/9		398 ,,
	Fancy (Covered)			65/6	31g	596 ,,
	Doffer	26″	,,	120/10	33g	5¾ ,,
	Scotch Feed.					

Carder.

2	Feed Rollers	2″	diam.	Garnett		—
	Lickerin	4¾″	,,	,,		76 r.p.m.
	Trimmer	9″	,,	100/9		198 ,,
	Swift	50″	,,	130/12	34g	102 ,,
5	Workers	7¾″	,,	130/12	34g	3 ,,
4	Strippers	4″	,,			382 ,,
	Fancy	12¾″	,,	70/7		374 ,,
	Fly Stripper	2¼″	,,			566 ,,
	Doffer	30″	,,	130/12	34g	5¼ ,,
	Angle	6″	,,	70/7	32g	180 ,,
	Swift	50″	,,	135/12		102 ,,
4	Workers	8¼″	,,	135/12	35g	2½ ,,
4	Strippers	4″	,,	110/10		338 ,,
	Fancy	12″	,,	70/7	33g	402 ,,
	Fly Stripper	2¼″	,,			544 ,,
	Tape Doffer	30″	,,	135/12	35g	3¼ ,,
	Stripping Roller	3½″	,,			20 ,,

4-height Redshaw Endless Tape Condenser, 120 good threads and 4 waste threads.
Single rubbers. 8 short bobbins.
Eccentric speed ... 268 r.p.m.
9″ diam. Surface drums 13 „

Output. 17.3 lbs. per hour of 17½ skeins cardings (280 yds. per ounce).

Spinning. 360 Spindle Mule by Curtis, Parr & Madeley.
Net draw 68⅝″.
927 turns per draw.
2 draws per 60 secs.

LOT B.

Machine same as Lot A.
Surface drum speed increased to 15 r.p.m. and creel feed and tape doffer altered to correspond.

Output. 20.0 lbs. per hour of 17½ skeins cardings.

Spinning. 360 Spindle Mule by Curtis, Parr & Madeley.
Net draw 70¾″.
948 turns per draw.
3 draws in 68 secs.

LOT C.

Platt Machine—Iron—60″ wide.
Open Belt Drives.
Tatham Automatic Hopper Feed.

Scribbler.				
3	Feed Rollers	2″ diam.	Garnett	—
	Lickerin	12″ „	12's n.p.	44 r.p.m.
	Lickerin	12″ „	Fillet	160 „
	Angle	6″ „		6 „
	Swift	50″ „	80/8	86 „
5	Workers	7¾″ „	80/8	6 „
5	Strippers	3½″ „	80/8	332 „
	Fancy (Covered)		60/6	482 „
	Doffer	30″ „	80/8	7 „
	Angle	5″ „		186 „
	Swift	50″ „	120/10	86 „
5	Workers	8¼″ „	120/10	3 „
5	Strippers	3½″ „	95/9	300 „
	Fancy (Covered)		70/7	408 „
	Doffer	30″ „	120/10	4½ „
	Dick Roller.			12 „
	Balling Machine.			
	Creel of 48 balls.			
Intermediate.				
3	Feed Rollers	2″ diam.		—
	Lickerin	9″ „		64 r.p.m.
	Angle	6″ „		308 „
	Swift	50″ „	130/11	90 „
4	Workers	8″ „	130/11	3¼ „
4	Strippers	3½″ „	95/9	262 „
	Fancy (Covered)	13″ „	70/7	342 „
	Fly Stripper	2″ „		340 „
	Doffer,	30″ „	130/11	5½ „
	Dick Roller			9 „
	Scotch Feed.			

Carder.

3	Feed Rollers	2″ diam.		—
	Lickerin	9″ ,,		62 r.p.m.
	Angle	6″ ,,		178 ,,
	Swift	50″ ,,	130/11	78 ,,
4	Workers	8″ ,,	130/11	4¼ ,,
4	Strippers	3½″ ,,	95/9	286 ,,
	Fancy	12½″ ,,	70/7	328 ,,
	Fly Stripper	2″ ,,		400 ,,
	Doffer	26″ ,,	130/11	7 ,,
	Angle	6″ ,,		188 ,,
	Swift	50″ ,,	135/12	78 ,,
4	Workers	8″ ,,	135/12	2¾ ,,
4	Stripers	3½″ ,,	95/9	302 ,,
	Fancy	12½″ ,,	70/7	320 ,,
	Fly Stripper	2″ ,,		180 ,,
	Ring Doffer	30″ ,,	135/12	5 ,,
	Stripping Roller.			—
	Divider.			—
	Surface Drums	9″ ,,		19¾ ,,

60 good threads and 2 waste threads.
¼″ Spaces.
Single Rubber.

Output. 12.1 lbs. per hour of 17½ skeins cardings.

Spinning. 450 Spindle (2″ pitch), mule by Curtis, Sons & Co.
Net draw 69⅜″.
940 turns per draw.

LOT D.

Platt Machine—Iron.
60″ wide. Open Belt Drives.
Tatham Automatic Hopper Feed.

Scribbler.

3	Feed Rollers	2″ diam.	Garnett	—
	Lickerin	12″ ,,		46 r.p.m.
	Angle	4″ ,,		252 ,,
	Breast	28″ ,,	95/9	110 ,,
2	Workers	7½″ ,,	95/9	4 ,,
2	Strippers	4″ ,,	80/8	208 ,,
	Fancy (Covered)	11½″ ,,	60/6	254 ,,
	Doffer	18″ ,,	95/9	8 ,,
	Angle	7″ ,,		240 ,,
	Swift	50″ ,,	115/9	90 ,,
4	Workers	7½″ ,,	120/10	3 ,,
4	Strippers	4″ ,,	90/9	272 ,,
	Fancy (Covered)	11½″ ,,	60/6	522 ,,
	Doffer	30″ ,,	120/10	6 ,,

Balling Machine.
Creel of 60 balls.

Intermediate.

3	Feed Rollers	2″ diam.	Garnett	—
	Lickerin	6″ ,,	16's n.p.	30 r.p.m.
	Angle	5″ ,,		92 ,,
	Breast	30″ ,,	100/9	40 ,,
2	Workers	8″ ,,	110/10	2½ ,,
2	Strippers	4″ ,,		68 ,,
	Angle	6″ ,,		214 ,,
	Swift	50″ ,,	120/10	90 ,,
4	Workers	8″ ,,	120/10	2½ ,,
4	Strippers	4″ ,,	90/9	270 ,,
	Fancy (Covered)	12″ ,,	65/6	328 ,,
	Doffer	30″ ,,	120/10	5 ,,

Scotch Feed.

Carder.

2	Feed Rollers	2″ diam.	Garnett	—
	Lickerin	11½″ ,,	Garnett	66 r.p.m.
	Angle	5″ ,,		300 ,,
	Swift	50″ ,,	130/12	92 ,,
4	Workers	8¾″ ,,	130/12	3⅛ ,,
4	Strippers	4″ ,,		296 ,,
	Fancy	13¾″ ,,	70/7	394 ,,
	Fly Stripper	3″ ,,		382 ,,
	Doffer	30″ ,,	130/12	6 ,,
	*Angle	5″ ,,	70/7	244 ,,
	Swift	50″ ,,	135/12	92 ,,
4	Workers	8¾″ ,,	135/12	2½ ,,
4	Strippers	4″ ,,	110/10	322 ,,
	Fancy	12½″ ,,	70/7	384 ,,
	Fly Stripper	3″ ,,		422 ,,
	Ring Doffer	30″ ,,	135/12	5 ,,
	Stripping Rollers			—
	Wooden Divider			—
	Surface Drums	9″ ,,		19¾ ,,
	Eccentric Speed			502 ,,

60 good and 2 waste threads.
Single Rubber.
*Belt cleaner driven from the angle.

Output. 12.8 lbs. per hour of 17½ skeins cardings.

Spinning. 315 Spindle Mule by Hetherington & Co.
Net draw 69¾″.
940 turns per draw.

LOT E.

Machine same as Lot D.
Surface Drum speed reduced to 18 r.p.m., and creel and ring doffer altered to correspond.

Output. 11.65 lbs. per hour of 17½ skeins cardings.

Spinning. As Lot D.

LOT F.

Machine by Leach (Rochdale)—Iron.
Scribbler 66″ wide. Carder 60″ wide.
Open Belt Drives.
Cliffe Hopper Feed.

Scribbler.

3	Feed Rollers	2″ diam.	(2 n.p. and 1 fillet)	—
	Lickerin	10″ „	20's n.p.	21 r.p.m.
	Angle	5½″ „		—
	Breast	30″ „	80/8	24 „
2	Workers	9″ „	80/8	3 „
1	Stripper	4½″ „	70/7	60 „
	Angle	5½″ „		150 „
	Swift	52″ „	105/10	60 „
4	Workers	9″ „	110/10	3 „
4	Strippers	4½″ „	80/8	150 „
	Fancy (Covered)	15″ „	65/6	256 „
	Doffer	30″ „	110/10	5 „
	Angle	5½″ „		60 „
	Swift	52″ „	125/10	60 „
4	Workers	9″ „	125/10	4 „
4	Strippers	4½″ „	90/9	190 „
	Fancy (Covered)	15″ „	70/7	316 „
	Doffer	30″ „	125/11	6 „

Scotch Feed.

Carder.

3	Feed Rollers	2″ diam.		—
	Lickerin	4¼″ „		54 r.p.m.
	Trimmer	8½″ „		54 „
	Angle	6¾″ „		—
	Swift	52″ „	130/11	60 „
5	Workers	8¾″ „	130/11	4¾ „
4	Strippers	4½″ „	90/9	204 „
	Fancy	15″ „	70/7	232 „
	Fly Stripper	2″ „		272 „
	Doffer	30″ „	135/11	6 „
	Angle	6″ „		186 „
	Swift	52″ „	135/11	60 „
4	Workers	8¾″ „	135/11	3¼ „
3	Strippers	4½″ „	90/9	200 „
	Fancy	12½″ „	75/7	320 „
	Fly Stripper	2½″ „		250 „
	Tape Doffer	36″ „	135/11	3⅓ „

Stripping roller 2¼″ diam.
3-height Series Tape Condenser, Single Rubbers.
90 good and 2 waste threads.
Eccentric Speed 278 r.p.m.
Surface drums, 9″ diam. 14 „

Output. 15.45 lbs. per hour of 17½ skeins cardings.

Spinning. Mule by Curtis, Sons & Co.
Net draw 69½″.
964 turns per draw.
4 draws in 105 secs.

LOT G.

(a) Machine by J. Hetherington & Sons Ltd.—Wood.
72″ wide throughout. Open Belt Drives.
Cliffe Hopper Feed.

Scribbler.

3	Feed Rollers	3″ diam.	14's n.p.	—
	Lickerin	12″ „	14's n.p.	40 r.p.m.
	Angle	7″ „	40/4	278 „
	Swift	54″ „	70/7	75 „
4	Workers	9″ „	75/7	28 „
4	Strippers	4½″ „	60/6	166 „
	Fancy	13″ „	50/5	328 „
	Doffer	45″ „	75/7	30 „
	Dick Roller	4″ „		
	Angle	7″ „	60/6	68 „
	Swift	54″ „	110/10	84 „
4	Workers	9″ „	115/10	28 „
4	Strippers	4½″ „	70/6	218 „
	Fancy	13″ „	60/6	392 „
	Doffer	45″ „	120/10	28 „
	Angle	7″ „	70/6	68 „
	Swift	54″ „	130/11	84 „
4	Workers	9″ „	135/11	4 „
4	Strippers	4½″ „	90/8	126 „
	Fancy	13″ „	65/6	338 „
	Fly Stripper	2½″ „	90/8	250 „
	Doffer	45″ „	135/11	4¼ „
	Dick Roller	4½″ „		
	Scotch Feed.			

Carder.

3	Feed Rollers	3″ diam.	16's n.p.	—
	Lickerin	9″ „	16's n.p.	66 r.p.m.
	Trimmer	12″ „	70/6	200 „
	Angle	7″ „	70/6	62 „
	Swift	54″ „	110/10	60 „
4	Workers	9″ „	120/10	20 „
4	Strippers	4½″ „	80/8	148 „
	Fancy	13″ „	60/6	276 „
	Doffer	45″ „	130/11	23 „
	Angle	7″ „	80/8	66 „
	Swift	54″ „	130/11	70 „
4	Workers	9″ „	135/11	12 „
4	Strippers	4½″ „	85/8	190 „
	Fancy	13″ „	65/6	328 „
	Fly Stripper	2½″ „		380 „
	Doffer	45″ „	135/11	12 „
	Angle	7″ „	85/8	132 „
	Swift	54″ „	135/11	70 „
4	Workers	9″ „	135/11	5 „
4	Strippers	4½″ „	90/8	114 „
	Fancy	13″ „	65/6	398 „
	Fly Stripper	2½″ „		574 „
	Tape Doffer	48″ „	130/12	2¼ „
	Stripping Roller	2½″ „	110/10	—

4-height Redshaw Lister Endless Tape Condenser.
Tandem Rubbers. 120 good and 4 waste threads.
Surface Drums 8¾″ diam. 13¾ r.p.m.
Eccentric Speed 226 ,,

Output. 16.5 lbs. per hour of 18 skeins cardings.

Spinning. 420 Spindle Mule (1914) by Brooks & Doxey.
Net draw 79½″.
1123 turns per draw.

(b) Machine by Rhodes—Wood.
Scribbler 72″ wide—open belt drive.
Carder 60″ wide—crossed belt drive.
Cliffe Hopper Feed.
No particulars of cards available.

Scribbler.

2	Feed Rollers	2″ diam.	—	
	Lickerin	13″ ,,	32	r.p.m.
	Angle	5¾″ ,,	150	,,
	Breast	34″ ,,	60	,,
2	Workers	8″ ,,	14	,,
2	Strippers	4½″ ,,	128	,,
	Fancy	13½″ ,,	220	,,
	Doffer	32″ ,,	12	,,
	*Angle		10	,,
4	Swifts	40″ ,,	104	,,
4	Doffers	32″ ,,	10, 10, 8 & 6	,, respectively
8	Workers	8″ ,,	10, 10, 8 & 6	,, ,,
8	Strippers	4¾″ ,,	238	,,

Dick Roller on last doffer.
*Running in direction opposite to the usual.
Scotch Feed.

Carder.

3	Feed Rollers		—	
	Lickerin		20	r.p.m.
	Angle		80	,,
	Breast	45″ diam.	26	,,
3	Workers	9″ ,,	8½	,,
3	Strippers	5″ ,,	36	,,
	Angle		260	,,
	Swift	54″ ,,	63	,,
4	Workers	9″ ,,	8½	,,
4	Strippers	5″ ,,	86	,,
	Fancy	13″ ,,	336	,,
	Doffer	36″ ,,	8	,,
	Angle	6″ ,,	78	,,
	Swift	54″ ,,	63	,,
4	Workers	9″ ,,	3½	,,
4	Strippers	5″ ,,	252	,,
	Fancy	13½″ ,,	368	,,
	Double Doffers	24″ ,,	5	,,

Stripping Rollers.
Tandem Rubbers—Haigh Condenser.
72 good and 2 waste threads.
Surface Drums 8¾″ diam. 14 r.p.m.
Eccentric Speed 402 ,,

Output. 9.2 lbs. per hour of 19½ skeins cardings.

Spinning. 432 Spindle Whiteley Mule.
Net draw 78½".
1184 turns per draw.

LOT H.

Continental Type Machine by Platt Bros.—Iron.
72" wide.
Open Belt Drive on Scribbler.
Crossed Belt Drive on Carder.
Hopper Feed by John Haigh & Co.

Special Features. Machine covered in entirely.
Bushed bearings.
Outside drives.
Garnett breast on Scribbler and fillet breast on Carder, chain driven, the remainder of the machine being belt driven.

Scribbler.

3	Feed Rollers	2¼" diam.		—
	Lickerin	8" "	Garnett	46 r.p.m
	"	12" "	"	162 "
2	Workers	5" "	"	—
2	Strippers	2¾" "	"	—
	Stripper	8" "	70/7	462 "
	Swift	50" "	120/12	144 "
5	Workers	6" "	125/12	5 "
5	Strippers	2¼" "	90/9	640 "
	Fancy	8" "	60/6	920 "
	Fly Stripper	1¾" "		
	Doffer	12" "	125/11	7 "
	Angle	2¼" "		
	Fly Stripper	1¾" "		502 "
	Fancy	8" "	60/6	920 "
	Fly Stripper	1¾" "		
	Roller between 12" Doffer Angle and Auxiliary Swift	6" "		210 "
	Auxiliary Swift	15" "	125/11	162 "
	Doffer	36" "	125/11	3 "

Scotch Feed taken off middle of lattice sheet.

Carder.

3	Feed Rollers	2¼" diam.		
	Lickerin	8" "	120/10	52 r.p.m.
	"	12" "	120/10	154 "
2	Workers	5" "	135/11	10 & 5 r.p.m. respectively
2	Strippers	2¾" "	120/10	52 r.p.m.
	Stripper	8" "	90/9	308 "
	Swift	50" "	135/11	144 "
5	Workers	6" "	135/11	6 "
5	Strippers	2¼" "	110/10	642 "
	Fancy	8" "	70/7	914 "
	Fly Stripper	1¾" "		304 "
	Doffer	12" "	140/12	10 "

Angle	2¼″ diam.			84 r.p.m
Fly Stripper	1¾″ „			—
Fancy	8″ „		70/7	914 „
Fly Stripper	1¾″ „			—
Roller between 12″ Doffer Angle and Auxiliary Swift	6″ „			194 „
Auxiliary Swift	15″ „		140/12	166 „
Tape Doffer	36″ „		140/12	2¾ „

4-height Platt Series Tape Condenser.
140 good and 4 waste threads.
Single Rubbers.
Surface Drums 5″ diam. 21 r.p.m.
Eccentric Speed 268 „

Output. 18.8 lbs. per hour of 20 skeins cardings.

Spinning. 385 Spindle Whiteley Mule.
80¼″ net draw.
1115 turns per draw.

LOT J.

Machine by Platt Bros.—Iron.
Scribbler 72″ wide.
Carder 60″ wide.
Cliffe Hopper Feed. Open Driving Belts.

Scribbler.

3	Feed Rollers	2″ diam.	16 n.p.		—	
	Lickerin	11″ „	d.p.		32	r.p.m.
	Angle	6″ „	50/6	24g	150	„
	Breast	45½″ „	70/7	27g	70	„
4	Workers	9″ „	75/7	28g	2¾	„
4	Strippers	4½″ „	60/6	26g	180	„
	Fancy (Covered)	11″ „	50/5	26g	395	„
	Fly Stripper	3″ „	50/6	24g	544	„
	Doffer	30″ „	75/7	28g	2¾	„
	Angle	6″ „	60/6	28g	120	„
	1st Swift	50″ „	100/9	31g	80	„
4	Workers	9″ „	110/10	31g	4	„
4	Strippers	4½″ „	70/6	28g	226	„
	Fancy	11″ „	60/6	31g	383	„
	Fly Stripper	3″ „	50/6	24g		
	Doffer	36″ „	110/10	31g	4½	„
	Angle	6″ „	70/6	29g	120	„
	2nd Swift	50″ „	120/10	32g	80	„
4	Workers	9″ „	125/10	32g	3	„
4	Strippers	4½″ „	80/8	30g	249	„
	Fancy (Covered)	11″ „	65/6	32g	380	„
	Fly Stripper	3″ „	60/6	26g	538	„
	Doffer	36″ „	125/10	32g	4	„
	Angle	6″ „	80/8	30g	120	„
	3rd Swift	50″ „	130/11	32g	76	„
4	Workers	9″ „	130/11	33g	2¾	„
4	Strippers	4½″ „	80/8	33g	218	„
	Fancy (Covered)	11″ „	70/6	32g	358	„
	Fly Stripper	3″ „	70/7	28g	475	„

	Doffer	36″ diam.	130/11	33g		3¼ r.p.m.
	Angle	6″ ,,	90/9	31g		130 ,,
	4th Swift	50″ ,,	135/11	33g		77 ,,
4	Workers	9″ ,,	135/11	34g		2½ ,,
4	Strippers	4½″ ,,	90/9	31g		250 ,,
	Fancy (Covered)	11″ ,,	75/7	33g		392 ,,
	Fly Stripper	3″ ,,	70/7	28g		247 ,,
	Doffer	36″ ,,	135/11	34g		3 ,,
	Dick Roller		90/9			7 ,,
	Scotch Feed					

Carder.

3	Feed Rollers	2″ diam.	16 n.p.			—
	Lickerin	11″ ,,	d.p.			34 r.p.m.
	Angle	6″ ,,	50/6	24g		180 ,,
	1st Swift	50″ ,,	135/11	33g		66 ,,
4	Workers	9″ ,,	135/11	33g		3 ,,
4	Strippers	4½″ ,,	90/9	32g		180 ,,
	Fancy	12″ ,,	70/7	33g		303 ,,
	Fly Stripper	3″ ,,	80/8	31g		403 ,,
	Doffer	36″ ,,	135/11	34g		4 ,,
	Angle	6″ ,,	90/9	32g		100 ,,
	2nd Swift	50″ ,,	135/11	34g		66 ,,
4	Workers	9″ ,,	135/11	34g		2 ,,
4	Strippers	4½″ ,,	90/9	32g		116 ,,
	Fancy	12″ ,,	70/7	33g		328 ,,
	Fly Stripper	3″ ,,	80/8	31g		444 ,,
	Tape Doffer	36″ ,,	130/12	33g		2 ,,
	Stripping Roller					16 ,,
	Eccentric Speed					178 ,,
	Surface Drums 8″ diam.				1st half	9 ,,
					2nd ,,	15 ,,

4-height Series Tape Condenser (Platt). 112 good and 4 waste threads.
Single Rubbers.

Output. 9·4 lbs. per hour of 17½ skeins cardings at 9 r.p.m.
15·7 ,, ,, 15 ,, ,, ,,

Spinning. 420 Spindles Platt Mule.
79″ net draw.
1209 turns per draw.
Platt Spinning Frame.

LOT K.

Tatham Machine—Iron.
60″ wide throughout.
Open Belt Drives.
Automatic Hopper Feed.

Scribbler.

3	Feed Rollers	2″ diam.			—
	Lickerin	12″ ,,	Garnett		75 r.p.m.
	Angle	4″ ,,			378 ,,
	Breast	40″ ,,	110/10		112 ,,
3	Workers	6¾″ ,,	110/10		9½ ,,
3	Strippers	3″ ,,	110/10		378 ,,
	Fancy (Covered)		30/6	28g	358 ,,
	Doffer	27″ ,,	110/10		9½ ,,

	Angle	7″ diam.	130/12		472 r.p.m.
	Swift	50″ „	130/12		114 „
6	Workers	6¾″ „	130/12		6½ „
5	Strippers	3″ „	110/10		472 „
	Fancy	12½″ „	30/6	28g	540 „
	Doffer	30″ „	130/12		6½ „

Balling Machine and Creel of 60 balls.

Intermediate.

3	Feed Rollers	2″ diam.			—
	Lickerin	9″ „	Garnett		90 r.p.m.
	Angle	5″ „	130/12		304 „
	Swift	50″ „	130/12		114 „
8	Workers	6¾″ „	130/12		7 „
7	Strippers	2½″ „	110/10		304 „
	Fancy	13″	30/6	30g	546 „
	Doffer	30″ „	130/12		7 „

Balling Machine and Creel of 60 balls.

Carder.

3	Feed Rollers	2″ diam.			—
	Lickerin	9″ „	Garnett		78 r.p.m.
	Angle	5″ „	140/12		310 „
	Swift	50″ „	140/12		78 „
8	Workers	6¾″ „	140/12		5½ „
7	Strippers	2½″ „	110/10		310 „
	Fancy	13″ „	30/6	30g	348 „
	Ring Doffer	30″ „	140/12		5″ „
	Stripping Roller	1¾″ „	120/10		
	Dividing Roller				
	Eccentric Speed				268 „
	Surface Drums	9″ „			20 „

Single Rubbers.
60 good threads, no waste threads.
¾″ wide rings and ¼″ spaces on ring doffer.

Output. 16.7 lbs. per hour of 13.7 skeins cardings.
12.4 „ „ 18.4 „ „

Spinning **(a) Drawing and Spinning.**

(1) Drawing. 360 Spindle Platt Mule fitted with Thurlow Patent Speed Governor.
Net draw 71¼″.
Slubbing delivery 42½″ of 14.0 skeins.
492 turns per draw—left hand twist.
17 secs. per draw.

(2) Spinning. Tatham Mule with Thurlow Patent Speed Governor.
Net draw 75¼″.
Roving delivery 54¾″
1486 turns per draw—right hand twist.
30 secs. per draw.

(b) Direct Spinning.
Tatham Mule with Thurlow Patent Speed Governor.
Net draw 74¼″.
1010 turns per draw.

Times. Scribbler 31½ hrs. for 516 lbs.
Direct Spinning 27 hrs. for 201 lbs. yarn.
Drawing 17 hrs. for 200 lbs. yarn.
Spinning 25 hrs. for 200 lbs. yarn.

LOT L.

Machine by Platt Bros.—Iron.
60″ wide throughout.
Open Belt Drives.
Cliffe Hopper Feed.

Scribbler.

3	Feed Rollers	1¾″ diam.		—
	Lickerin	12″ ,,		42 r.p.m.
	Angle	4″ ,,		286 ,,
	Breast	50″ ,,	100/9	72 ,,
5	Workers	8″ ,,	100/9	11¾ ,,
5	Strippers	3¼″ ,,		230 ,,
	Fancy	13½″ ,,	28g	270 ,,
	Doffer	27″ ,,		8½ ,,
	Angle	6″ ,,		260 ,,
	Swift	50″ ,,	120/10	110 ,,
4	Workers	8″ ,,		14 ,,
4	Strippers	3¼″ ,,		290 ,,
	Fancy	13½″ ,,	28g	492 ,,
	Doffer	27″ ,,	120/10	8 ,,
	Dick Roller	4″ ,,		21 ,,

Balling Machine.
Creel of 60 balls.

Intermediate.

3	Feed Rollers	1¾″ diam.	16 n.p.	—
	Lickerin	5¾″ ,,		144 r.p.m.
	Trimmer	8″ ,,		266 ,,
	Angle	3¼″ ,,		8 ,,
	Swift	50″ ,,	130/11	96 ,,
5	Workers	8″ ,,		8 ,,
5	Strippers	3¼″ ,,		320 ,,
	Fancy	13½″ ,,	28g	366 ,,
	Doffer	27″ ,,	130/11	5 ,,

Scotch Feed.

Carder.

3	Feed Rollers	1¾″ diam.	Garnett	—
	Lickerin			50 r.p.m.
	Angle			300 ,,
	Swift	50″ ,,	130/11	80 ,,
5	Workers	8″ ,,		4½ ,,
5	Strippers	3¼″ ,,		299 ,,
	Fancy	13½″ ,,		264 ,,
	Doffer	27″ ,,		6 ,,
	Angle			146 ,,
	Swift	50″ ,,	135/11	80 ,,
4	Workers	8″ ,,		4½ ,,
4	Strippers	3¼″ ,,		298 ,,
	Fancy	13½″ ,,		256 ,,
	Ring Doffer	36″ ,,		4¾ ,,

Surface Drums 9″ 16 r.p.m. for 18¾ skeins cardings.
Eccentric Speed 414 ,,
52 good and 2 waste threads.

Output. 8.45 lbs. per hour of 18¾ skeins cardings.

Spinning. (a) **Drawing and Spinning.**

(1) Drawing. Platt Mule, 390 Spindles.
Net draw 70″.
Slubbing delivery 43.3″ of 14.8 skeins.
Turns per draw 505.

(2) Spinning. Platt Mule. 390 Spindles.
Net draw 72″.
Roving delivery 51.3″.
Turns per draw 1492.

(b) **Direct Spinning.**
Platt Mule. 390 Spindles.
Net draw 70″.
Turns per draw 969.

Times. Carding 50 hours.
Direct Spinning 26 hours (202 lbs. of yarn).
Drawing 17 hours (209 lbs. of yarn).
Spinning 28 hours (209 lbs. of yarn).

LOT M.

Machine by John Haigh—Wood (1919).
Scribbler 66″ wide.
Carder 60″ wide.
Crossed Belt Drives.
Haigh Hopper Feed.

Scribbler.

3	Feed Rollers	2″	diam.	Garnett	—
	Lickerin	6″	,,	,,	60 r.p.m
	Trimmer	12″	,,	70/7	70 ,,
	Angle	7″	,,	70/7	9¼ ,,
	Breast	50″	,,	90/9	49 ,,
3	Workers	12″	,,	90/9	6 ,,
3	Strippers	5″	,,	80/8	136 ,,
	Fancy	12″	,,	60/6	220 ,,
	Doffer	50″	,,	100/9	8 ,,
	Angle	7″	,,	100/9	160 ,,
	1st Swift	50″	,,	110/10	66 ,,
3	Workers	12″	,,	110/10	7 ,,
3	Strippers	5″	,,	90/9	194 ,,
	Fancy	12″	,,	70/7	364 ,,
	Doffer	50″	,,	120/10	8 ,,
	Angle	7″	,,	120/10	88 ,,
	2nd Swift	50″	,,	120/10	66 ,,
3	Workers	12″	,,	120/10	4 ,,
3	Strippers	5″	,,	110/10	198 ,,
	Fancy	12″	,,	80/8	348 ,,
	Doffer	50″	,,	120/10	5½ ,,
	Angle	7″	,,	125/11	76 ,,
	3rd Swift	50″	,,	125/11	66 ,,
3	Workers	12″	,,	125/11	2½ ,,
3	Strippers	5″	,,	110/10	192 ,,
	Fancy	8″	,,	80/8	366 ,,
	Doffer	50″	,,	125/11	2½ ,,

Scotch Feed.

Carder.

3	Feed Rollers	2″ diam.	Garnett	—
	Lickerin	6″ „	„	76 r.p.m.
	Trimmer	12″ „	110/10	213 „
	Angle	7″ „	110/10	5 „
	1st Swift	50″ „	130/11	66 „
3	Workers	12″ „	130/11	5 „
3	Strippers	5″ „	120/10	181 „
	Fancy	12″ „	80/8	337 „
	Fly Stripper	2½″ „		344 „
	Doffer	50″ „	130/11	5¼ „
	Angle	7″ „	130/11	159 „
	2nd Swift	50″ „	135/11	66 „
3	Workers	12″ „	135/11	3¼ „
3	Strippers	5″ „	125/11	207 „
	Fancy	12″ „	80/8	324 „
	Fly Stripper	2½″ „		325 „
	Tape Doffer	50″ „	135/12	2¾ „

Stripping Roller.

Haigh 4-height Tape Condenser, 96 good and 2 waste threads, 8 short bobbins.

Tandem Rubbers.

Surface Drums 8″ diam. 18 r.p.m. for 20 skeins cardings.
16 „ „ 17¾ „ „

Eccentric Speed 230 r.p.m.

Output. 14.24 lbs. per hour of 17¾ skeins cardings.

Spinning. 324 Spindles, Brooks & Doxey Mules.
Net draw 68″.
985 turns per draw for yarn from 20 skeins cardings.
1013 „ „ „ 17¾ „ „

Stembridge & Co. Ltd., Printers, Top of Albion Street, Leeds.